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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/809,398	03/26/2004	Hiroyuki Fukuyama	1691-0177PUS2	7540

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EXAMINER	
SONG, MATTHEW J	
ART UNIT	**PAPER NUMBER**
1722	

DATE MAILED: 06/07/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/809,398	FUKUYAMA ET AL.	
	Examiner	Art Unit	
	Matthew J. Song	1722	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *28 March 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1 and 2* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1 and 2* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 2/28/2006 has been entered.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claim 1 is rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Nakamura et al (EP 0 999 640 A2).

Nakamura et al discloses a sapphire single crystal made of α-Al_2O_3 and an initial nitriding treatment to from a very thin aluminum nitride single crystal ([0018]-[0021]). Nakamura et al also discloses an initial nitriding treatment is performed heating a sapphire single crystal substrate to 950°C and introducing an ammonia gas together with a carrier gas consisting of hydrogen and nitrogen. Nakamura et al also discloses a very thin AlNO film is formed during this initial nitriding treatment, this reads on applicant's aluminum oxynitride layer ([0035]-[0036]). Nakamura et al also discloses a very thin aluminum nitride single crystal film is formed uding the initial nitriding treatment ([0021]) and an AlNO film is also formed during the initial nitriding treatment ([0036]).

Nakamura et al does not specifically teach the AlNO film is single crystalline, however this feature is inherent. The AlNO layer formed on the sapphire substrate is inherently single crystalline because the AlN film, which is formed on the sapphire substrate during the same nitriding treatment is single crystalline ([0021]); therefore AlN single crystal film must be formed on a single crystal material to a single crystal orientation because the AlN mimics the orientation of the substrate, which is the thin AlNO layer formed on the sapphire substrate. In the alternative, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Nakamura et al to have a AlNO single crystalline layer.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person

> having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nakamura et al (EP 0 999 640 A2) as applied to claim 1 above, and further in view of Bolt (US 4,857,246).

Nakamura et al discloses all of the limitations of claim 2, as discussed previously, except Nakamura et al does not teach the substrate is nitrided by heating in the presence of carbon, nitrogen and carbon monoxide.

In a method of forming aluminum nitride by nitridation, note entire reference, Bolt teaches a stoichiometric excess of carbon ensures conversion of alumina to aluminum nitride. Bolt also teaches a carbonization step may be combined with the nitridation step (col 3, ln 25-35). Bolt also teaches one mole of alumina reaction with three moles of carbon and one mole of nitrogen to produce two moles of aluminum nitride and three moles of carbon monoxide at temperatures above 1500°C, this clearly suggests applicant's nitrided by heating in the presence of carbon, nitrogen and carbon monoxide (col 3, ln 1-67 and col 1, ln 40-67). Bolt also teaches the carbonization step and the nitridation may be combined (col 3, ln 25-35). It would have been

obvious to a person of ordinary skill in the art at the time of the invention to modify Nakamura et al by nitriding in the presence of carbon, nitrogen and carbon monoxide, as taught by Bolt, to ensure unreacted alumina in the final product is avoided.

Double Patenting

6. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970);and, *In re Thorington,* 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

7. Claims 1-2 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claim 3 of copending Application No. 10/937,344. Although the conflicting claims are not identical, they are not patentably distinct from each other because 10/937,344 claims forming a highly crystalline aluminum nitrided by nitriding a single crystal a-alumina substrate in the presence of carbon, nitrogen and carbon monoxide to form aluminum oxynitride and a highly crystalline aluminum nitride film (claim 3).

10/937,344 claims forming a highly crystalline aluminum nitride film and a single crystalline aluminum nitride film. A highly crystalline aluminum nitride film anticipates a single crystalline film because a single crystalline film is a highly crystalline film. A person of ordinary

skill would have found it obvious to grow a single crystalline film in view of 10/937,344 teaching of growing a highly crystalline film because more ordered structures are desirable.

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

Response to Arguments

8. Applicant's arguments filed 2/28/2006 have been fully considered but they are not persuasive.

Applicant's argument that Nakamura et al does not teach forming a single crystalline AlON layer is noted but is not found persuasive. Nakamura et al discloses forming a single crystalline AlN layer and an AlON layer during an initial nitriding step. The AlON necessarily is single crystalline because the AlN formed thereon is single crystalline and a single crystal mimics the orientation of the underlying substrate. An amorphous or polycrystalline AlON would not result in a single crystalline AlN film; therefore the AlON is single crystalline.

Applicant's argument that Nakamura et al teaches forming a buffer layer and an AlN film using MOCVD is noted but is not found persuasive. Nakamura et al does teach forming a buffer layer and an AlN film via MOCVD, as suggest by applicant, however the initial nitriding step of Nakamura et al which is performed prior to the deposition of the buffer layer or the MOCVD step reads on applicant's invention. During the initial nitriding step taught by Nakamura et al, an AlON layer is formed and a single crystal AlN layer is formed, which reads on applicant's forming a single crystalline AlON layer and AlN layer by nitriding a Al_2O_3 substrate.

Applicant's argument that Bolt teaches mixing aluminum oxide and solid carbon together cannot result in an aluminum nitride film with excellent crystallinity is noted but is not found persuasive. Bolt teaches a carbonization step may be combined with the nitridation step (col 3, ln 25-40), this reads on applicant's nitrided by heating in the presence of carbon, nitrogen and carbon monoxide. The carbonization step can be performed while the nitridation step and is not required prior to the nitridation step. The presence of carbon will ensure a conversion of alumina to aluminum nitride (col 3, ln 30-40). Referring to applicant's argument regarding the crystallinity of the AlN film, Bolt teaches using a carbonization step to ensure a conversion of alumina to aluminum nitride. The substrate Bolt teaches is not single crystalline; therefore the aluminum nitride film is not expected to be single crystalline. However, in combination with the teachings of Nakamura, which teaches using a single crystalline sapphire substrate to produce a single crystalline AlN by nitriding, the film is expected to be single crystalline. The combination of the Nakamura and Bolt teaches forming a single crystalline AlN film.

Applicant's argument regarding the provisional double patenting rejection is noted but is not found persuasive. The instant application is not in condition for allowance; therefore the rejection is maintained, while both applications are pending.

Applicant's argument that co-pending application requires a reaction under a specific reaction condition, which is claimed in the instant application is noted but is not found persuasive. Although, the co-pending application also claims additional limitations, the limitations of the instantly claimed invention would have been obvious in view of the co-pending claims because the instantly claimed invention is broader in scope than the co-pending application in regards to the method of production.

Conclusion

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J. Song whose telephone number is 571-272-1468. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Yogendra Gupta can be reached on 571-272-1316. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

YOGENDRA N. GUPTA
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700

Matthew J Song
Examiner
Art Unit 1722

MJS
May 18, 2006